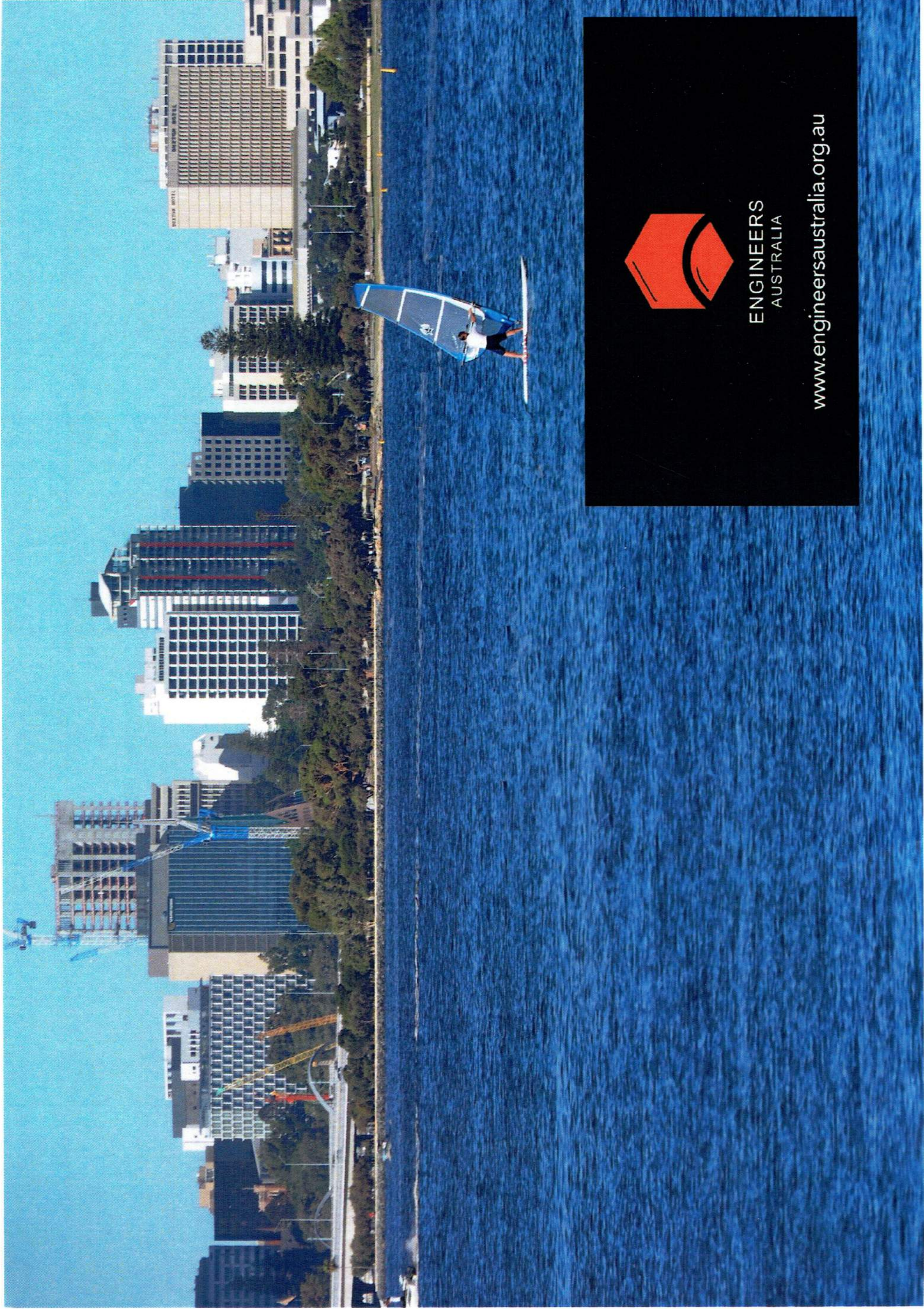


SWAN RIVER WA

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Engineering the Swan – February 2017

This tour and accompanying booklet documents the general history of changes in the Swan River and adjacent shores between Fremantle and Perth Waters from the early 1890's through to 2017.

We acknowledge the work of T.G. Leaver to compile this information.

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Henry Willey Reveley (1788-1875) was a [civil engineer](#) responsible for the earliest public works at the [Swan River Colony](#), the foundation of the state of [Western Australia](#).

1. TRANSPORT OF SUPPLIES

In the late 1890's, the first hydrographic survey was carried out of the Swan and Canning rivers, and the result of this survey identified a channel of approximately 4m below Low Water Mark (LWM) Fremantle between North Fremantle and the Narrows Perth.

From the late 1890's and into the 1900's, transport of a large quantity of goods for the development of the Colony was via the Swan River. The goods were off loaded from vessels berthed in Outer Fremantle, moved across land and re-loaded into large wooden barges - well over 35m long and over 3m deep. These were then towed along the river by steam driven tugs to a land backed wharf which had been constructed several years earlier between William Street and Mill Street. The wharf was operated by the Swan River Shipping Company ^[1].

To cope with the increase in river traffic between Fremantle and Perth, in the early 1900's, a 2m deep channel was dredged from the Narrows to the land backed wharf.

With the advent of improving road transport, and the use of trucks, river transport slowly decreased; however, barges were still used up to the beginning of WWII in 1939. Following retirement, the wooden barges were stored at mooring piles adjacent to Harvest Road, North Fremantle, where, before disposal, several sank and now rest on the bottom of the river ^[2].

Subsequent to the water transport ceasing, the Mill Street land backed berth and adjacent area was used by the Public Works Department (PWD) as a depot for the various dredging operations throughout the river. This depot was in use up to the late 1950's when it had to be removed for the new reclamation works between the new Narrows Bridge and Mounts Bay Road.

2. DREDGING AND RECLAMATION

Dredging works within Perth Waters and throughout the Swan River down to Fremantle were under the control of the Public Works Department, with the first major dredging commencing in Perth Waters in 1893. The barge mounted grab dredge was known as the “Black Swan” [3]. The “Black Swan” was loaned to the Perth City Council to carry out the reclamation of the Perth foreshore between Barrack and William Streets, later becoming the Perth Esplanade.

Following work on the Canning River (using convict labour) between 1892 and 1896, the “Black Swan” commenced dredging a channel in 1897 between Barrack Street and Mend Street. The initial dredging was at 1.3m and was deepened to 1.4m in 1900. Channels were also dredged between Barrack Street and Coode Street, and from Barrack Street to the Narrows channel. Waste from these projects was dumped into natural deep water in the vicinity.

Barrack St. Square was reclaimed in mid-1904, within pitched shell banks, with spoil dredged from various channels in Perth Waters.

In 1928 the Government purchased a new 0.5m cutter suction dredge, the “Stirling”, which discharged spoil through a floating pipeline to shore or to deep water.

Between 1929 and the mid. 1970's (when the dredge was decommissioned) a variety of works were carried out between Perth Waters and North Fremantle, with mainly flood control works further upstream of the Causeway.

In 1964 the Government purchased a small 0.2m cutter suction dredge, named “Leschenault” which, apart from undertaking numerous works away from Perth, carried out several projects in the metropolitan area. These include dredging a channel from the new Mend Street Jetty to Coode Street Jetty, widening the turning basin at Mend Street and a clean-up at Barrack Street.

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3. MAJOR DREDGING PROJECTS CARRIED OUT BY THE “STIRLING”

MOSQUITO CONTROL

Where large low lying foreshore areas were reclaimed with dredged material. Affected areas included Nedlands, Dalkeith, Subiaco, Melville, South Perth, Royal Perth Yacht Club and Langley Park.

FORESHORE PROTECTION

At Pelican Point, downstream of Canning Bridge, Point Heathcote, Como, South Perth, Point Walter, Preston Point and upstream and downstream of Stirling Bridge, at North Fremantle. The latter covered an area that had been used for many years for ferry operations, jetty construction plant, and a Wool Scour works. Over recent years the downstream area at North Fremantle location has been extensively developed. The two large works at Point Walter and Como involved dredging from adjacent off shore areas and depositing the spoil along the fore shores, providing wide beach areas, however, over the past 40 odd years, the protective material was washed away, (primarily during storms and high tides) requiring the local authorities (Cities of South Perth and Melville) having to undertake “hard” foreshore protective works to avoid further erosion - carried out over the past five (5) years.

RECREATION

The areas reclaimed for mosquito control were subsequently used for recreation. Other locations created for recreation included Sir James Mitchell Park (Como), Pt Heathcote (S.P.Y.C), Applecross, Point Walter, Attadale, and Preston Point (S.Y.C). During the 1960's, the “Stirling” carried out numerous works of dredging and reclamation for improvements of yachting and other recreational facilities i.e. sailing, rowing, scouts, and power boats.

NAVIGATION

Apart from the channels dredged between the Narrows and Barrack Street, and Barrack and Mend Street, two other navigation channels were dredged - one through the shore bank near the Perth Flying Squadron and the other through Rocky Bay Bank at Preston Point – to avoid the ferries having to go around the large banks.

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CONSTRUCTION

From 1956 to 1960, the “Stirling” assisted by the dredge “Throsby”, completed the reclamation necessary for the construction of the Narrows interchange from the new bridge to Mounts Bay Road, and the Kwinana Freeway to the Como foreshore.

4. FERRY OPERATIONS

In the early days of the settlement before railways, the quickest form of transport for work and pleasure between Fremantle and Perth was by boat. Over a period of years from the late 1800's to the early 1900's, a series of timber jetties were constructed at several locations along the river to cater for ferries. These included: Harvest Road, North Fremantle; Mosman Bay; Keane's Point; Claremont; Nedlands; Mill Street, Perth; and Barrack Street, Perth and Coode Street, South Perth among others.

Mill Street jetty was removed in the late 1950's as a result of the Narrows development, and its age and condition. With the exception of Harvest Road and Beach Street, all the other jetties were progressively replaced either in timber or steel piles with a concrete deck, during the mid-1960's to late 1980's.

Apart from the transport of goods, recreational use of the river from the late 1800's to mid 1900's became a popular event, with ferries making use of all jetties, particularly Point Walter due to the attractiveness of large grassed areas.

Early on, the ferries comprised a number of “Val” boats and three steam operated vessels, the “Duchess”, “Emerald” and the “Zephyr”.

The “Duchess” was primarily used on the Barrack - Mends St passenger service, assisted by the Val boats. The Val boats also carried out services to Fremantle and Rottnest Island (subject to weather).

The “Emerald” and the “Zephyr” were mainly used for the Rottnest service and were extremely popular. In the 1960's these two vessels were replaced by an ex - navy boat - “Rottnest Islander II” and the “Temeraire”. The service later became privately owned, operating with new vessels.

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Captain Cook Cruises operates two steel vessels on a daily basis between Perth and Fremantle, James Stirling and Captain Cook, plus several other smaller craft.

5. OTHER PUBLIC ACTIVITIES

Swimming was very popular, and early in the 1900's seven (7) public swimming facilities were constructed. Claremont, Nedlands, Matilda Bay, Crawley Bay, Como, Applecross and Bicton.

Claremont and Nedlands had high diving platforms, and together with Crawley Bay, had a timber lattice work around the perimeter to minimise the entry of floating debris and jelly fish. The other facilities were open with some seating. Several of these facilities were used for inter-school events. All these facilities (with the exception of Matilda Bay) were progressively removed from the mid - 1900's, due to age and the opening of the Beatty Park swimming facility. The Matilda Bay piled structures have been replaced with floating platforms.

Throughout the 1900's, major yacht clubs were established at East Fremantle, Claremont, Nedlands Perth Flying Squadron, Royal Freshwater Bay, South of Perth, Royal Perth and Swan. In addition, two sailing clubs and two rowing clubs.

6. FORESHORE PROTECTION

Foreshore walling, comprising pre-cast 1.5m long concrete sections, positioned on a limestone base, was installed along the reclaimed land at Nedlands, and South Perth from Queens Street through to Sir James Mitchell Park. Nedlands received general maintenance mid - 1970's, and a section of the South Perth walling from Queen Street towards Mend Street Jetty was reconstructed in the early 1990's. Timber birdsmouth sheeting was initially used to protect the shore, from Queens Street to the Narrows Bridge - (this section was reconstructed early 1990's using stone mattresses) - and the shore to the south of the bridge around to a small rock groyne.

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The City of South Perth commenced reconstruction of similar concrete walling east of Mend Street jetty, in the latter part of 2016.

The shoreline stretches for approximately 200m downstream of the Narrows Bridge on the North side, fronting Mounts Bay road, and was initially protected in the early 1980's, and reconstructed in the early 1990's using Gabion rock filled wire mattresses. During the past 2-3 years this location was again rebuilt using medium size granite rock facing.

Limestone walling was constructed in the early 1900's to protect the roadway along the perimeter of Mounts Bay road just north of the old brewery, down to what became known as "Nattrass Jetty", just north of U.W.A boat shed. Sections of this walling have received extensive repairs in the last 2 - 4 years.

Over a period of many years, the Como foreshore, south and north of the Como jetty, has suffered severe erosion, resulting in rock facing work on the south side, and large sand bags (and groynes) along the north side. This reparation work is currently undertaken by the City of South Perth.

A similar problem had occurred at Point Walter, and to save what was left, the City of Melville carried out limestone protective works, including several groynes, four years ago. Another location that required reconstruction (with limestone rock facing) is a section along Melville Beach Parade.

7. RECREATIONAL BOATING

With the increasing number of power boats using the river, commencing in the early 1960's, public launching ramps were constructed at Deep Water Point, Preston Point (Leeuwin), and Point Walter. The Leeuwin ramp was rebuilt in the latter part of 2016.

Earlier ramps that are still in use are include Coode Street, Matilda Bay and Crawley Bay (Qantas).

Power boat numbers state wide have increased some 90,000 in the past 50 years.

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8. FORESHORE CHANGES

North Fremantle-Prior to the start of WWII in 1939, the area downstream of the Harvest Road Jetty was being used for small boat servicing. This changed, with a larger slipway being constructed and medium size wooden vessels being built for the Army and Navy. After the War, a private company, Dillinghams, successfully requisitioned the government for a 300 tonne slipway at the site ^[4]. In the late 1960's to early 1970's the area was reorganised and the Pier 21 Restaurant was constructed. This development later incorporated Apartments with boat mooring facilities - as existing now.

The area on the north side between the old traffic bridge and Stirling Bridge (before reclamation) was used by a small marine company and Wool Scour works.

Following forward planning, these operations ceased and the area was reclaimed in 1965 using sand from adjacent areas in the river.

Subsequently, town houses were constructed, followed by apartment blocks, of which units in the latest development are currently on sale.

Rocky Bay - a three story red brick building (left from the old "Burfords" soap factory), fronting Rocky Bay, was converted into apartments many years ago.

The housing development along the northern side of Rocky Bay up to Chidley Point, was originally the location of the State Engineering Works, Cumming Smith Mount Lyall fertiliser works and a Sugar Refinery. Initially the S.E.W and C.S.M.L sites were cleared, and before any housing could proceed, large quantities of soil and other materials had to be removed and replaced with clean sand.

Following on from the first development, the remaining area from the C.S.M.L site, and the Sugar Works facility, was sold and subsequently developed with more housing. Both of these developments have taken place over the past fifteen years.

The S.E.W had been established in the early 1900's and was one of the largest engineering workshops in W.A. throughout the 1900's. It was

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involved in the servicing of naval vessels and submarines based in Fremantle during WW II, and the fabrication of steel pontoons for armed forces. Components of the pontoons were skidded down the banks for final assembly on platforms at the water's edge.

9. BARRACK STREET DEVELOPMENT

The original development consisted of a 170m longitudinal timber wharf, with four (4) finger timber jetties extending out from the wharf, for use by ferries and excursion steamers. These structures were maintained over the years, however, they had finally reached the end of their economic life by the late 1960's and a programme of replacement jetties was initiated.

The facility was operated by the Harbour and Light Department, and apart from the jetty replacements, the firm required a separate structure for their own, and the Police Department's use. An additional jetty was also required to cater for the increase in passenger numbers on the ferry services between Barrack and Mend Street, and as part of the Public Transport System along the river and to Rottnest Island.

It was essential that the replacement work (undertaken by the Harbours and Rivers Branch, PWD) be carried out in a manner to ensure minimum disruption to the various operators using the complex, particularly the MTT and the Rottnest ferries.

To provide for the H&L facility and No. 5 jetty, it was necessary to extend the basin area 80m upstream and shore wards to Riverside Drive. This was dredged by the "Stirling" in 1972 to a depth of 2.4m below the low water mark.

Progress of the project was subject to the availability of loan funds, and throughout the several years of work, close liaison was maintained with the Harbour and Light Department in respect to the programme of replacement.

The H & L Jetty (35m x 7.5m) was designed for 50 tonne vessels, has 350 mm sq. pre stressed concrete piles varying in length from 9m to 17m, with a concrete deck. Construction commenced June 1972 and was completed in

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April 1973. Test piles at the site of No. 5 jetty (55m x 9m), designed for 400 tonne vessels, revealed a depression in the river bed foundation, requiring 17m long piles to achieve the design set.

Due to the river foundation, the jetty has “tanolith treated” timber piles (four rakers per pier) with cast-in-situ concrete pile caps, pre-stressed concrete headstocks, pre-cast deck sections and fender apron slabs, with a cast-in-situ top slab.

Construction commenced in April 1973 and was completed in April 1975. The extended period was due to the availability of loan funds at the time and the supply of materials. On its completion, the larger Rottnest Island Ferries were relocated to No. 5 enabling a re-arrangement of boats using the No.1 jetty.

Initially, jetties 1 and 2 were used for 150 tonne vessels, and 3, 4 and 5 for 400 tonne vessels however, in early discussions, it was decided to design all jetties to provide for the larger vessels, and keep the basic shape of jetties 1 to 4 (and Mend Street) the same to economise on formwork cost. Timber fenders were to be used on jetties 1, 2 and Mend Street, and a flexible rubber system using two ‘D’ shaped rubber fenders (one above the other) on jetties 3, 4, and 5. The size of each of these five jetties was 58.3m long and 9m wide.

The ground conditions at jetties 1 to 4 inclusive were good (clay and some coffee rock), and open ended steel tube piles were used, with a cast-in-situ concrete deck and apron slab.

- Construction of No. 1 jetty commenced in October 1974 and was completed in December 1975.
- Construction of No. 2 jetty commenced in June 1975 and was completed in June 1976.
- Construction of No. 4 jetty commenced in February 1976 and was completed in 1977.
- Construction of No. 3 jetty commenced in November 1977 and was completed in October 1978.

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The original longitudinal timber wharf was replaced with a new steel sheet pile solid fill Quay structure - 141m long x 8.1m wide plus 19m of piled structure. A 30m section of quay was constructed with each jetty.

Due to a layer of mud immediately behind the sheet pile wall, a surcharge of 1m of fill was placed and left until settlement stopped. In due course, surplus sand was moved forward to the next section of wall.

A novel feature of the redevelopment was the provision of a "Vacuum Sewerage System" which operates on each jetty for the disposal of sewage from the ferries. The sewage is drawn from the ferries and discharged through P.V.C pipes to an adjacent holding tank and then into the Metropolitan Sewerage System.

The attached photos show a construction phase of No.5 Jetty, the completed complex at Barrack Square 1980, a view of the facility as it exists now, Barrack Street area late 1890's and one of the Val boats.

10. MEND STREET JETTY

Due to manoeuvring problems with the vessels and the available turning basin, it was decided to position the new structure 15m upstream from the original structure.

Timber test piles were driven and whilst these indicated an intermediate load bearing strata, it was decided to take the piles down to firmer strata which required 29m of open ended tube piles. Construction commenced in November 1974 and was completed in April 1976.

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11. ELIZABETH QUAY

This is the latest development on the Swan River in Perth Waters. There is only an average tidal difference of 0.225m in the river level between Perth and Fremantle. The daily difference between low and high tides at Fremantle is in the order of 0.5m, with winter tides averaging 0.75m and summer tides averaging 0.5m ^[5].

Considering the irregular shape of the river and the distance between Fremantle and Perth, there is little to no chance of the water way flushing itself naturally, and therefore future action will be necessary to ensure the lagoon does not become badly discoloured and stagnant. The ferries using the area only agitate the top level of water.

Arup was awarded the buildings and structures category prize for the Elizabeth Quay Pedestrian and Cyclist Bridge at the 2016 Engineers Australia Engineering Excellence Awards for WA.

Did you know? The Reveley Bar at Elizabeth Quay is named after Henry Willey Reveley (1788-1875). He was a civil engineer responsible for the earliest public works at the Swan River Colony, the foundation of the state of Western Australia.

Check out the Swan River News from 1844 which contains an article by Reveley on the china clay of the Swan River:

<http://www.nla.gov.au/ferguson/14605996/18440101/00020001/1-5.pdf>

12. GENERAL COMMENT

Many discussions have taken place over the years in respect to making more use of the river in providing ferry access to the City, particularly in the mornings and late afternoons.

Several operators have endeavoured to run a service from various locations but have failed due to lack of patronage. Until such time as there is sufficient available vehicle parking at each jetty to be used, such a service will not be viable. It is a known fact that, in the case of the rail service, the parking areas are filled to capacity very early in the mornings.

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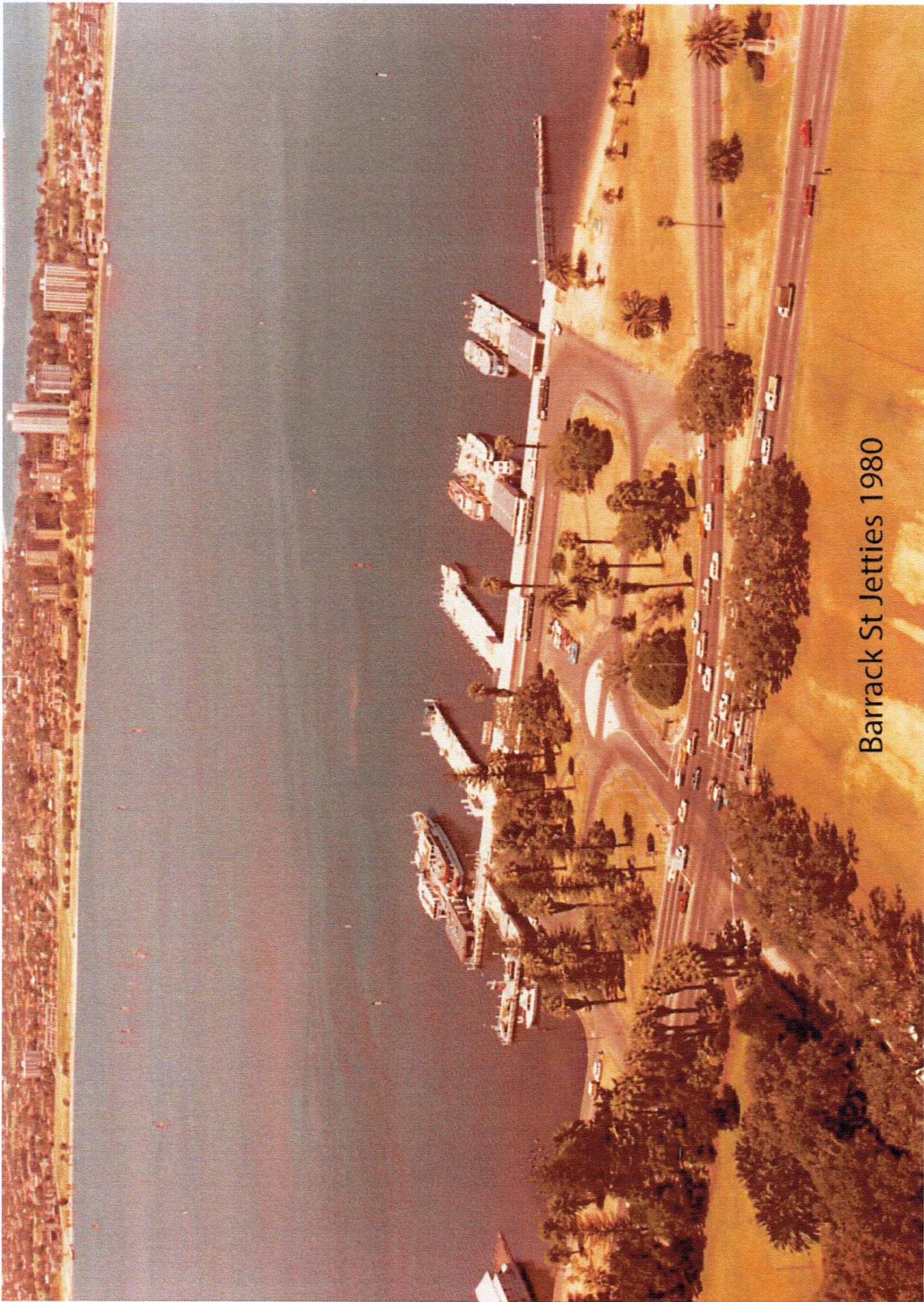
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PHOTOGRAPHS

1. Cover- Image from Shutterstock
2. Inside cover (front) – Mike Corboy
3. Barrack Street Jetty No.5 under construction – TG Leaver
4. Barrack Street Jetties 1980 – IPWEA
5. Barrack Street Jetties 2016 -
<http://www.cityseeker.com/perth/146160-barrack-street-jetty>
6. Perth Water Circa 1900 – The West Australian
7. Ferry Mayflower on flooded Swan River -
<https://southperthlocalhistory.wordpress.com/tag/ferry/>
8. Inside Cover (Back) – Image from Shutterstock- Elizabeth Quay Pedestrian and Cyclist Bridge

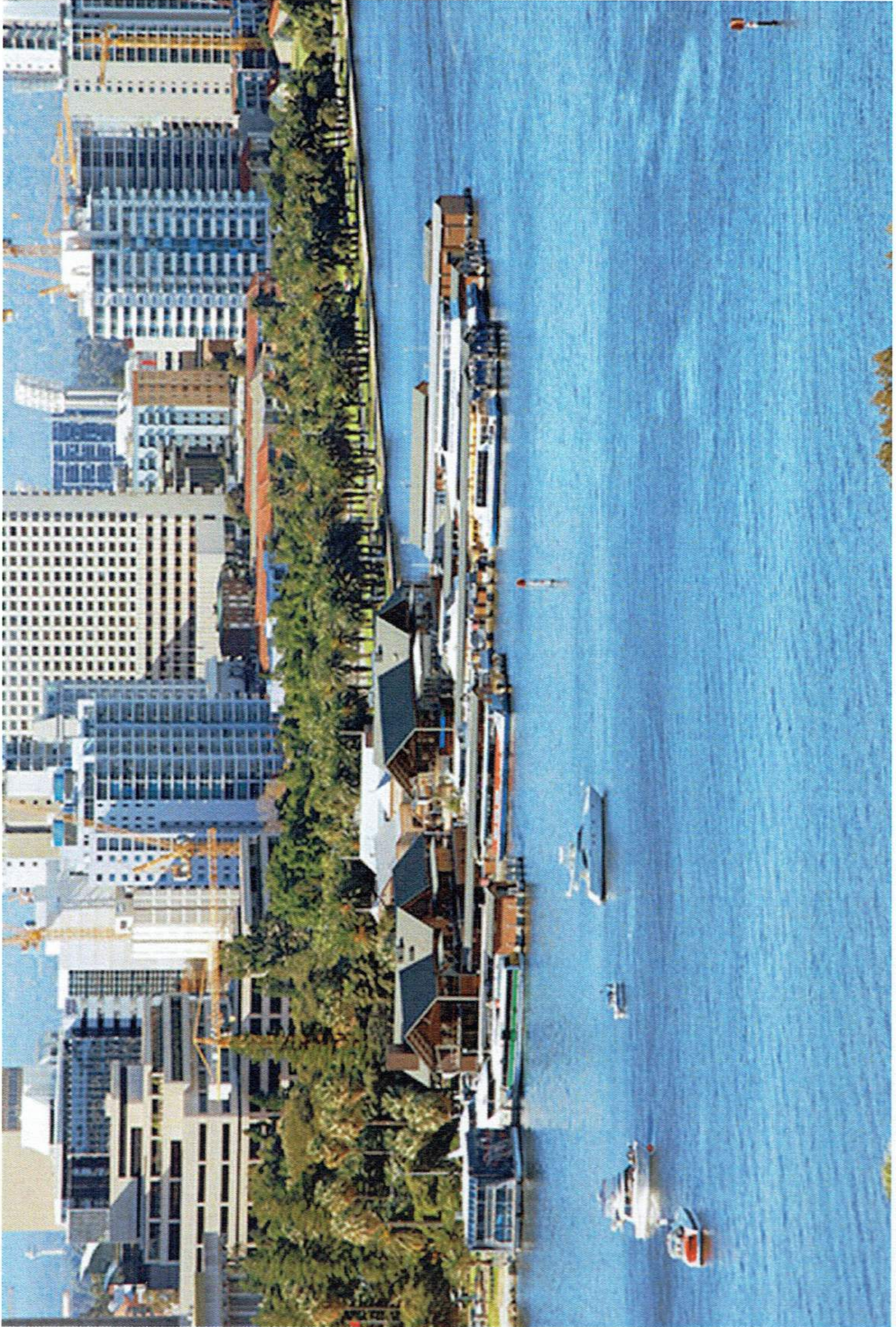
Barrack Street Jetty No.5 Under Construction





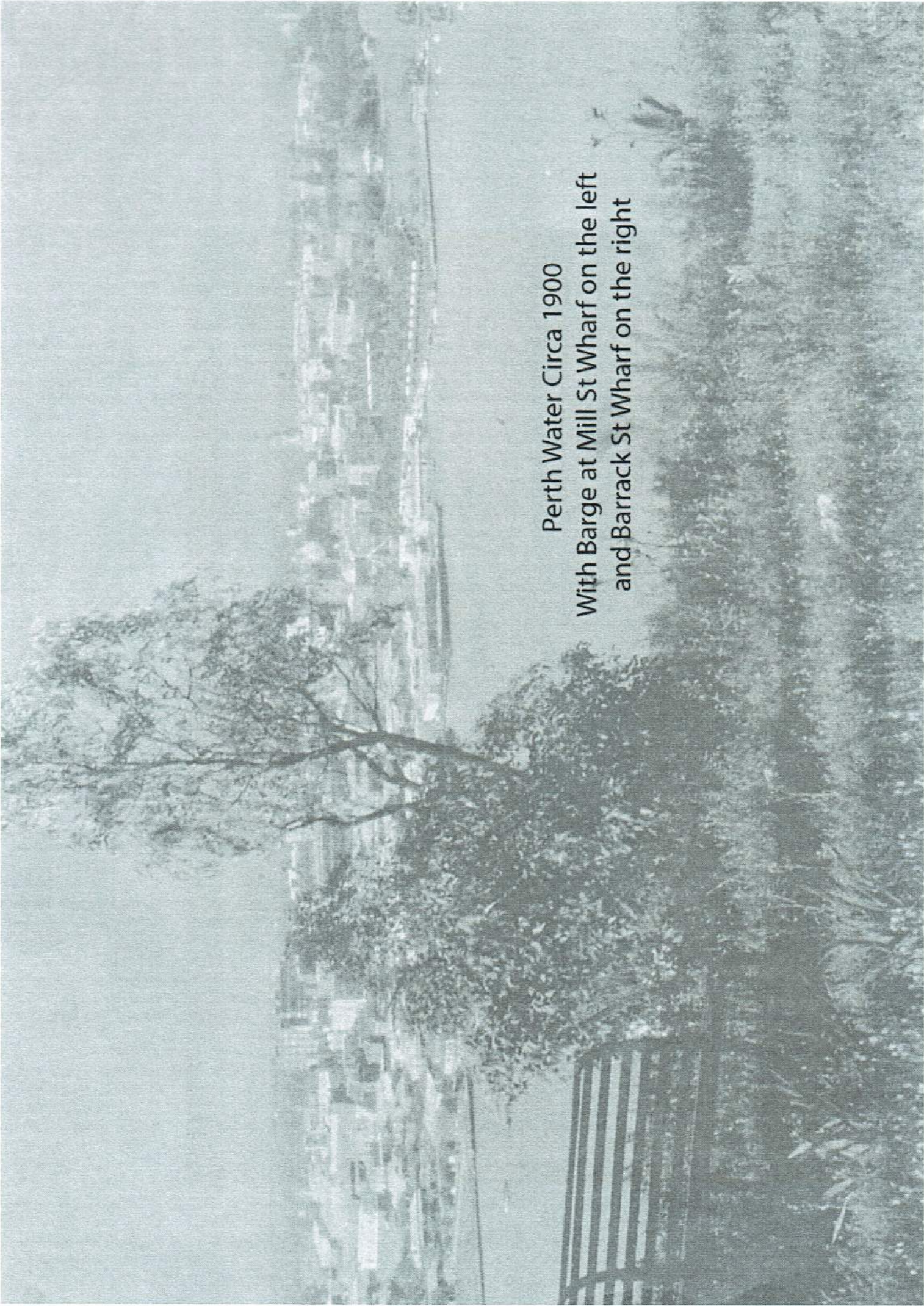
Barrack St Jetties 1980

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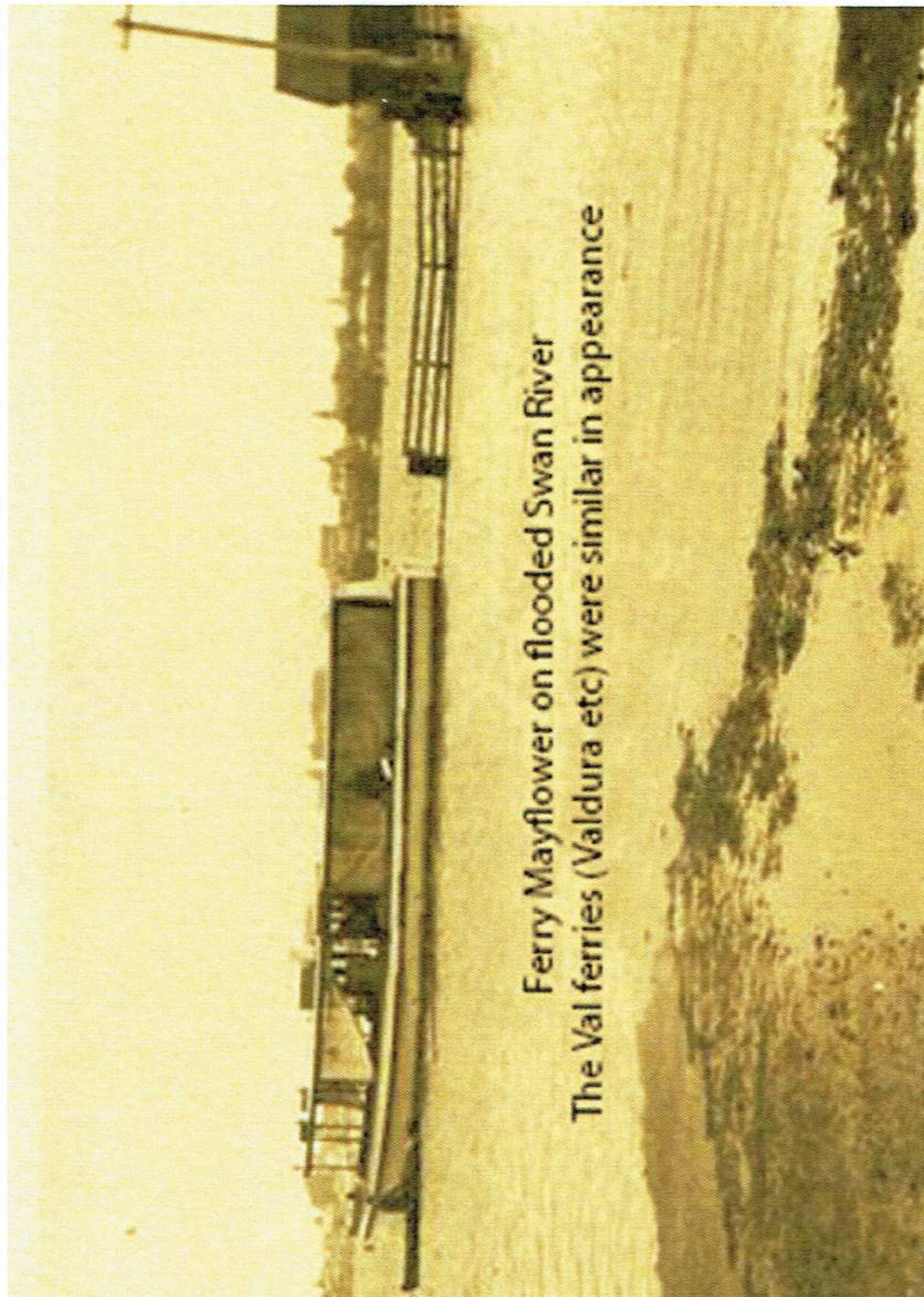
Barrack Street Jetties 2016

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Perth Water Circa 1900
With Barge at Mill St Wharf on the left
and Barrack St Wharf on the right

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